

Patent claims

- 5           1. A system comprising an assembly for storage or transport of compressed gas on a floating structure (1; 10), wherein the assembly (3) comprises a plurality of separate, parallel laying pipes (4) which are closed at both ends and are supported by a supporting structure (5; 40), **characterised in that** the pipes (4) are releaseably attached to the supporting structure (5; 40) only at one end thereof, where the pipes are coupled to a manifold system (6) for filling or emptying of the pipes, and that the supporting structure (5; 40) is arranged to allow unobstructed longitudinal guiding of the pipes (4) in the assembly (3), so that the pipes individually or in groups can be introduced to or removed from their operating position in the assembly (3) via openings at the end of the assembly located oppositely to said one end.
- 15           2. A system according to claim 1, **characterised in that** the supporting structure (40) is solid and substantially fills the intermediate spaces between the pipes (4) in the assembly, the pipes being placed in individual holes (42) in the supporting structure and being continuously supported by the supporting structure (40) along their entire length.
- 20           3. A system according to claim 2, **characterised in that** the holes (42) in the supporting structure (40) in their entire length are clad by thin-walled lining pipes (43) sticking to the supporting structure and having an inner diameter that is somewhat larger than the outer diameter of the pipes (4).
4. A system according to claim 2 or 3, **characterised in that** the supporting structure (40) comprises non-combustible geo-material.
- 25           5. A system according to claim 4, **characterised in that** the supporting structure (40) comprises cast lightweight concrete.
6. A system according to claim 4, **characterised in that** the supporting structure (40) consists of prefabricated lightweight concrete elements (44, 45).
- 30           7. A system according to claim 1, **characterised in that** the supporting structure (5) comprises a steel framework comprising a number of racks arranged at intervals along the length of the pipes (4) and comprising support elements extending horizontally and vertically transversely to the pipes, so that they form cells for receiving and supporting individual pipes (4).
- 35           8. A system according to claim 1, **characterised in that** the supporting structure comprises a number of bulkheads (30) arranged at intervals along the length of the pipes (4) and extending transversely thereto, the bulkheads being provided with openings (31) for receiving and supporting individual pipes (4).

9. A system according to claim 8, **characterised in that** each of the bulkheads (30) is constructed as a sandwich structure consisting of perforated steel plates (32) with intermediate concrete (33).

10. A system according to any one of the claims 7-9, **characterised in that** each of the pipes (4) in assembled condition is surrounded by thin-walled lining pipes (43) having an inner diameter that is somewhat larger than the outer diameter of the pipes (4).

11. A system according to any one of the preceding claims, **characterised in that** groups of pipes at the same horizontal level in the supporting structure (5) are placed in respective cassettes (24) that are releaseably mounted in the storage assembly (3).

12. A system according to any one of the preceding claims, **characterised in that** the supporting structure (40) forms a structurally rigid block arranged at a deck on the floating structure (1; 10), and which constitutes an integrated part of the floating structure and contributes to the total rigidity and strength thereof.

13. A system according to claim 12, **characterised in that** the floating structure is an elongated vessel (1) of the single-hull type, wherein the storage assembly (3) is arranged on the deck (2) of the vessel between sidewall-forming parts (9) of the hull (8), the pipes (4) in the block extending parallel to the longitudinal axis of the vessel (1) from a forward to a rearward end of the vessel.

14. A system according to claim 12, **characterised in that** the floating structure is an elongated multi-hull vessel (10), wherein the storage assembly (3) is arranged on a common deck (11) between sidewall-forming parts (13) of the hull (12), the pipes (4) in the block extending parallel to the longitudinal axis of the vessel (10) from a forward to a rearward end of the vessel.

15. A system according to claim 13 or 14, **characterised in that** at least the sidewall-forming parts (9; 13) of the hull contains ballast tanks (15; 22) enabling submersion of the vessel (1; 10), so that the pipes (4) at selected levels of the block may be made floating with a view to mounting or dismounting of the pipes.

16. A system according to any one of the claims 13-15, **characterised in that** the manifold system (6) is located at the forward end of the vessel (1; 10) and is arranged in at least one closed manifold space (55) having a rearward end wall (69) to which the adjacent ends of the pipes (4) are releaseably attached.

17. A system according to claim 16, **characterised in that** vertical groups of pipes (4) are coupled to an appurtenant, vertically extending group manifold (56) having a blowout possibility (62) to the surroundings in the upwards direction.

18. A system according to any one of the claims 13-17, **characterised in that** the pipes (4) at least at one end are provided with a safety valve and a pipe means for emergency blowout.

19. A system according to any one of the claims 13-18, **characterised in that** the storage assembly (3) is built into a closed space (25) which is thermally insulated from the surroundings and provided with means for cooling of the interior of the space.

20. A system according to claim 19, **characterised in that** the closed space (25) at the rearward end of the pipes (4) is provided with a gate means which can be opened in case of installation and/or replacement of individual pipes (4) or groups of pipes.

21. A system according to any one of the claims 16-20, **characterised in that** the pipes (4) at their forward end are provided with an internal drain pipe (59) debouching into the manifold space (55), and which is arranged for emptying of a possible collected liquid from the pipes (4), in conjunction with a moderate forward trim of the vessel (1; 10).

22. A method for installation of pipes on a floating structure having a storage assembly according to claim 1, wherein the pipes (4) have an approximately neutral buoyancy in water, **characterised in that** the individual pipes (4) are provided in the relevant length on a production plant (75) and therefrom are guided into the water surrounding the floating structure (76) and are floated into the storage assembly, the floating structure being ballasted to a desired draft so that the relevant pipe can be floated directly into the correct position in the storage assembly (3).

23. A method according to claim 22, **characterised in that** the pipes (4) are provided by successive welding-together of suitable pipe lengths on a pipe-laying vessel (75).

24. A method according to claim 22 or 23, **characterised in that** a number of the provided pipes (4) are placed in a cassette (24) which is floated in place at a desired level in the storage assembly (3).

25. A method according to claim 22, when replacing pipes in the storage assembly, **characterised in that** the floating structure (76) is ballasted to the desired draft, and the relevant pipe or pipes is/are pulled out from the storage assembly by means of a towboat (77).

26. A method for installation of pipes on a floating structure having a storage assembly according to claim 1, **characterised in that** the pipes (4) are located in a storage plant on land and are transferred one by one to a mounting table (78) which is adjusted in vertical and horizontal direction so that the mounting table with the pipe is situated in the exactly correct linear position in relation to the relevant lead-in channel (81) in the storage assembly (3), and that the pipe (4) thereafter is pushed or pulled into the storage assembly and ahead to its mounting position in the assembly.